WEXFORD HARBOUR.

RETURN to an Order of the Honourable The House of Commons, dated 9 March 1860;—*for*,

COPY "of REPORT upon WEXFORD HARBOUR by Mr. *Coode*, C.E., and of the PLAN connected therewith, and of other PAPERS on the same Subject, to the Lords Commissioners of the Admiralty."

Admiralty,
12 March 1860.

C. H. PENNELL,
Chief Clerk.

The Deeps, Wexford,
2 June 1859.

Sir,

I HAVE been requested to bring under your notice that about 480 tons of sand are now raised daily from the shoal of Hantoon (one of the entrances to Wexford Harbour), under the authority of the "Admiralty Commission for Improving Wexford Harbour," and that the same is deposited in the middle of Coal Channel, in five fathom water, about a quarter of a mile from the fort of Rosslare.

Now, this place is about our deepest anchorage, and I shall feel obliged if you will inform me whether this deposit of material is made with the sanction of the Lords of the Admiralty.

I have, &c.
(signed) *J. E. Redmond.*

The Secretary of the Admiralty.

To the Lords Commissioners of the Admiralty.

The Memorial of the Merchants and Inhabitants of Wexford, in Public Meeting assembled, on Friday the 27th of May 1859,

Humbly showeth,

THAT your memorialists, in common with the whole community, are deeply interested in the improvement of the port of Wexford. That except for the shallowness of the water at the entrance of the harbour, Wexford is pointed out by nature as the proper place of postal communication between the south of Ireland, South Wales, and the southern districts of England, inasmuch as it is the shortest route between both countries, the distance from land to land being only 45 miles, which can be traversed by a steamer in three hours.

That an Act of Parliament was passed in the year 1846 to authorise, amongst other things, the "Wexford Harbour Improvement Company" to enclose a large tract of mudland within the harbour, to receive a certain portion of the tonnage rates of the port, and to undertake to make a sailing channel from the town to the sea of the depth of 11 feet at low water. That in 1851, the works above referred to for the improvement of the harbour, being executed only to a very limited extent, a local inquiry was held by order of the Lords of the Admiralty, when their Lordships recommended that the former Act should be repealed, and that the company should be limited to one object, viz., the reclamation of the submerged lands; that the said company should pay 20,000 *l.* to Her Majesty's Paymaster General, and in addition a certain annual conditional charge in liquidation of the obligations imposed on them in the first recited Act; and suggesting that contemplated improvements at the entrance of the harbour were of national importance, and ought to be executed at the national expense; that the duty of improving the harbour of Wexford should be transferred to the Lords of the Admiralty, who were to appoint Commissioners for carrying the same into execution, and that certain

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tonnage rates should be transferred for the same purpose, to Her Majesty's Paymaster General from the income of the port.

In conformity with the recommendation made by the Admiralty to Parliament, the Wexford Harbour Embankment Company's Act, 1852, was passed, embodying the above, and the improvement of the harbour devolved on the Admiralty Commissioners to be so appointed.

In 1853 a sum of 5,000 *l.*, portion of 20,000 *l.*, was paid by the Wexford Harbour Embankment Company to Her Majesty's Paymaster General as provided by the Act. In 1854 a second sum of 5,000 *l.* was also paid, and up to the year 1857 nothing was done towards the improvement of the harbour, although the entrances were in a most dangerous state. That several reports have been made to the Lords of the Admiralty pointing out how a greatly increased depth of water could be obtained at the entrance of the harbour of Wexford, at a moderate expense, which reports have been submitted by their Lordships to Parliament. After several remonstrances in the years 1857 and 1858, a dredge boat was placed, late in the latter year, by the Admiralty at Wexford, but so imperfectly supplied with necessary conveniences, that little work was done, and only a small temporary improvement effected, although, as your memorialists believe, a large outlay was incurred. Within the last week this work was resumed, but there is little probability, with the present limited appliances, that the work contemplated of 11 feet at low water from the quay to the sea can be accomplished within any reasonable period.

That it is with sorrow your memorialists have to refer to the recent loss of the "Pomona" emigrant ship on Blackwater Bank, within a few miles of the harbour of Wexford, when 424 human beings perished, and, as given in evidence before the inquiry instituted on that subject by the Board of Trade, most of them might have been saved had there been sufficient water on the bar of Wexford to allow the large steamers then in port to go out to her assistance, and which increased depth of water was provided by the above-named Act.

Under these circumstances your memorialists humbly beg to call the attention of your Lordships to the present state of the harbour, the value of its improvements to the public generally as well as to the immediate locality, and the saving of life and property.

Leaving therefore the improvement under the Act referred to completely under your Lordships' control, your memorialists indulge strong hopes that the depth of water shall be increased to 11 feet, and other improvements made as originally contemplated.

Your memorialists humbly pray your Lordships to have those improvements carried out with as little delay as possible, and in such manner as to your Lordships may seem meet.

And your memorialists will ever pray.

Signed on behalf of the meeting,

John Walsh, J.P.
And Mayor of Wexford.

Sir, Queen's Hotel, Cork-street, 10 June 1859.

Referring to the interview the Members of the county of Wexford and myself, accompanied by Sir Edward Grogan, had with the Admiralty, on Thursday last, relative to the improvement of Wexford Harbour, when I had the honour to present the memorial of the inhabitants of that town, praying their Lordships to cause the improvements contemplated under the Acts of 1846 and 1852 to be carried into effect, I have now to enclose, for the consideration of the Admiralty, the heads of a proposition which, if carried out, would enable the "Admiralty Commissioners for the Improvement of the Harbour of Wexford" to raise a fund capable of executing the works originally suggested, or others of equal or greater value, and one which I am sure, if recommended by their Lordships, and assented to by Treasury—the Harbour Commissioners of Wexford would willingly concur in.

The gentlemen who composed the deputation fully agree in the opinion expressed by yourself on Thursday, that it would be most desirable that the plan of proposed works for the improvement of Wexford Harbour should be submitted to, and reported on, by an engineer fully conversant with such works, and on whom the Admiralty and Treasury could both rely upon.

I have, &c.
(signed) *J. E. Redmond.*

The Right Hon. H. T. Corry, &c. &c.,
Admiralty.

WEXFORD HARBOUR.

In case the Lords of the Admiralty should be of opinion that the clauses in the Wexford Harbour Embankment Act, 1852, are not sufficiently definite (the funds provided by that Act proving insufficient) in securing to the port of Wexford the full execution of the improvements contemplated by the Act of 1846, the following suggestions are made with the view of meeting the case on fair and equitable grounds, and that this great public good of improving the port of Wexford should not be further delayed.

1. That the duty of improving the Harbour of Wexford should rest with the Commissioners appointed by the Admiralty under the provisions of the Act, 1852.

2. That two-thirds of the entire tonnage rates of the port should be assigned to the said Commissioners, (this sum would now amount to about 1,200 *l.* per annum, and increasing every year).

3. That the Commissioners be authorised to borrow on the security of such tonnage rates a sum not exceeding 30,000 *l.*

4. That the several sums payable by the Wexford Harbour Embankment Company, the dredge boat, plant, &c., and any balance not expended collectively of the value of about 20,000 *l.*, be approximated also to the same purpose, and vested in the Commissioners, thus placing at their disposal from local sources a sum equal to 50,000 *l.*

5. That a like sum, say 50,000 *l.*, should be added by a grant in aid from the Treasury, in consideration of the value of the position of Wexford as a postal communication, the development of the fisheries contiguous, and the greater facility such improvement would afford to the saving of life and property in the frequent shipwrecks that are occurring on the neighbouring banks, making in all a sum of 100,000 *l.* at the disposal of the Commissioners for the improvement of Wexford Harbour.

Works to be immediately carried out:—

1st. That a cut, connecting the Town Channel with Coal Channel, 100 yards wide, and about 2,000 yards long and 12 feet deep, be made through the slob lands, at a cost of about 10,000 *l.*, with the winter use of the dredgeboat and barges.

2d. That 80,000 cubic yards of sand should be dredged off Hantoon, cost 2,000 *l.*

3d. That a north breakwater from the Raven shore towards the Vane Buoy, about 1,700 yards long, should be made at a cost of about 30,000 *l.*

4th. That the expenditure of the balance of the money vested in the Commissioners, say 58,000 *l.*, should be deferred till the effect produced by these works was ascertained.

REPORT of Captain *Vetch*, on the Proposals contained in Mr. *Redmond's* Letter of 10th June 1859.

MR. REDMOND'S first proposition is "that the duty of improving the Harbour of Wexford should rest, as at present, with the Commissioners appointed by the Admiralty, under the provisions of the Act of 1852."

This proposition seems proper, always presuming that the works to be carried out be subject to the approval of their Lordships.

2d Proposition.—"That two-thirds of the entire tonnage rate of the port should be assigned to the above Commissioners. This sum would now amount to 1,200 *l.* a year, and is increasing."

To this proposal I can see no possible objection.

3d. Proposition.—"That the Commissioners be authorised to borrow, on the security of the said tonnage rates, a sum not exceeding 30,000 *l.*"

I see no objection to this proposal.

4th. Proposition.—"That the several sums payable by the Wexford Harbour Embankment Company, the dredge boat, plant, &c. &c., and any balance not expended, collectively of the value of 20,000 *l.*, be appropriated also to the same purpose, and vested in the Admiralty Commissioners." (Total from local sources 50,000 *l.*)

I assume by this proposal that Mr. Redmond considers the plant should be disposed of, and the work done by contract. The best method of executing such works is by contract, and if I properly understand his meaning, I see no objection to the proposal No. 4.

5th Proposition.—"That a sum of 50,000 *l.* should be added, by a grant in aid from the Treasury, in consideration of the value of the position of Wexford as a postal communication, the development of the fisheries contiguous, and the greater facility such improvements would afford to the safety of life and property in shipwreck."

I consider that a sum of 50,000 *l.*, as a grant in aid, would be well bestowed on improving Wexford Harbour, to be added to local funds of an equal amount.

Mr. Redmond's proposals for "works" to be executed by the above 100,000 *l.* if obtained, are:—

1. That a cut, connecting the town channel with the coal channel, 100 yards wide, and about 2,000 yards long, and 12 feet deep, be made through the slob lands, at a cost of about 10,000 *l.*

2. That 80,000 yards of sand should be dredged off Hantoon, cost 2,000 *l.*

3. That a north breakwater from the Raven shore towards the Vine Buoy, about 1,700 yards long, should be made at a cost of 30,000 *l.*

4. The expenditure of the balance to be deferred until the effect produced by the proposed works be ascertained.

I agree with Mr. Redmond as to the first of his proposed works, and also as to the second, as a temporary measure. I consider the third would be a good work, but doubt if it could be executed for the money named (30,000*l.*), but eventually a south breakwater should be added.

The characters of works which I would propose for the improvement of Wexford Harbour are as hereafter detailed.

In the year 1855 at the request of Admiral Beaufort, I reported on the improvement of Wexford Harbour, for the guidanceof the Admiralty Commissioners under the Act of 1852.

Seeing at that time the great extent and cost of works necessary for the removal of the bar, and for providing a good navigation inside, and at the same time the small amount of sums available for the objects in view, I recommended that to meet the outlay the funds should be carefully husbanded, and accumulated, until a sufficient sum had accrued to proceed with the works with some vigour and effect, and I then learned that my views and recommendations would be attended to.

I assumed that there would be available (in a few years) a sum of about 20,000 *l.* for works, and that an income of 1,000 *l.* per annum would probably arise in harbour dues, available for the improvements, on which revenue a loan of 10,000 *l.* might be obtained, giving a total capital for works, amounting to 30,000 *l.*

As regards the internal improvements, I could see no question as to the most beneficial work, viz.:—the connecting the deep coal channel on the east, with the deep town channel on the west, which would give a continuous and deep channel from the bar to Carrick Bridge, a distance of eight miles, with a general depth of not less than 18 feet.

A work so accomplished would, in my opinion, not only afford a shorter and deep channel, but a better line than the old north channel, which is tortuous, and not easily taken in hazy weather, and is composed of material more difficult to dredge, while the coal channel line is of a soft material and easily deepened, and it will be observed from the amended chart of 1856, that the line of low water mark has approached to the proposed cut of 1,200 feet since 1845, showing thus that natural operations are tending in that direction.

Should this work be accomplished there would, besides a good navigation, be a short and deep channel to sea, with an increased momentum to and across the bar.

I therefore feel further assured and satisfied that the work in question is no less facile than essential, and that no delay should take place in effecting this improvement, which alone might much improve the position and depth of the bar.

A report has reached the Admiralty that some of the material dredged from the Hantoon channel has been cast into the coal channel, but which I trust is not correct, otherwise no greater injury could arise than a step so interfering with future improvements.

The next important question in order is that of the improvement of the bar, about one mile from the shore.

In my report of 1855, I was under the impression that the sandbanks surrounding the sea channel had become of a fixed character, and that the Dogger bank was stationary, and under that impression I proposed two groynes, one on either side of the channel, to intercept the sand travelling along shore, and casting up banks on either side, and thus, by preventing all lateral escape from the inrunning and outrunning water of the tides, there would be so good a stream to sea as would keep open a channel of 15 feet, or more, at time of low water, which was the more reasonable, as the sea outside deepens to 30 feet at 450 yards from the bar; and I am of opinion, that had the work I proposed been now in existence the object would have been effected, and would have become permanent; and that, though the changes that have since taken place suggest a different line of groynes, still the only chance of giving a deep water entrance must consist in carrying groynes out to the two fathom line of soundings, one on either side of the channel.

Such works, I conceive, ought to be rubble stone, deposited from a tramway or staging, and I should recommend that, under the actual circumstances of the case, the northern groyne should be first carried out, somewhat in the direction of the line E F on the plan herewith.

Since I formerly reported, it appears that the shipowners and traders of Wexford became clamorous about the funds (10,000*l.*) being expended without loss of time, in improving the entrance to the harbour, and it appears that the Admiralty Commissioners, desirous of meeting the demands of local parties to deepen and improve the Hantoon channel, expended the following sums:

	£.
Purchase of a steam-dredger - - - - -	4,800
Purchase of mud barges, &c. - - - - -	2,362
Engineer's per-centage on above - - - -	358
Dredging Hantoon Channel, &c. - - - -	2,256
£.	9,776

The funds being now nearly exhausted, the dredging of the Hantoon Channel now in progress must shortly cease (unless 4,000*l.* owing by the Embankment Company to the Admiralty can be obtained), and the plant will then remain idle.

I may repeat here, that until the groynes alluded to by me, one on either side of the channel be run out (as shown on chart by blue lines E F, and G H, there can be no hope of a deep and permanent entrance to Wexford Harbour.

Note.—Captain Vetch's proposed works are shown by *blue* lines on Chart herewith.

15 June 1859. (signed) *James Vetch.*

Sir, Admiralty, 20 June 1859.

Mr. Redmond, m p., having addressed a letter to the Admiralty on the subject of the improvement of Wexford Harbour, and their Lordships having referred his letter to Captain Vetch to report upon it, I enclose copies of the letter and report, and I have to request that you will report, for the information of the Admiralty Commissioners for Wexford Harbour, your opinion as to the proposed works, with an estimate for the cut through the slob into the Coal Channel, and for the construction of a north pier, as shown on the annexed Plan.

As Captain Vetch's opinion is so decided against depositing the soil that is dredged up in the Coal Channel, I have to desire that you will at once take steps for towing the barges elsewhere, probably out to sea, and depositing the mud where it will be sure not to wash back into the harbour.

I am, &c.
(signed) *John Washington.*

James B. Farrell, Esq., C. E., Wexford.

REPORT of *J. B. Farrell*, Esq., C.E.

Gentlemen, Wexford, 24 June 1859.

I HAVE the honour to acknowledge the receipt of Captain Washington's letter of the 20th instant, accompanied by a report from Captain Vetch upon certain proposals made to the Lords Commissioners of the Admiralty by Mr. John E. Redmond, M.P., with reference to the improvement of Wexford Harbour. That report, adopting these proposals, recommends and describes "works to be immediately carried out." Two of the latter are of a heavy and expensive character; they form the leading feature of the whole scheme. Whether they shall be carried into execution or not, is a question of the most serious import, as upon the decision that shall be finally arrived at respecting it, depends the fate of this harbour.

To these two points you have particularly called my attention, and, in obedience to your instructions, I beg to lay before you the following report, with the estimates you require:—

The first work proposed is, "that a cut connecting the Town Channel with Coal Channel, 100 yards wide and about 2,000 yards long, and 12 feet deep, be made through the slob lands, at a cost of about 10,000 *l.*"

To this Captain Vetch assents, remarking that "as regards the internal improvements," he "could see no question as to the most beneficial work, viz., the connecting the deep Coal Channel on the east with the deep Town Channel on the west, which would give a continuous and deep channel from the bar to Carrick Bridge, a distance of eight miles, with a general depth of not less than 18 feet."

He thus appears to be of opinion that the depth to be obtained should approximate to the general depth of the channels he would connect. In this I should agree with him, because, in order to render the momentum of the tidal currents through the cut of full efficiency, all obstructions to the free and full flow of the ebb and flood from those channels through it should be removed, and one uniform plane, as nearly as it may be practicable to make it, should be obtained in the bottom. And, further, the width of the new channel should, in like manner as its depth, be so proportioned as gradually to approach that of the channel into which it is intended finally to pass, so that at their junction their sectional areas should be equal.

If these conditions were attended to and the cut well executed in accordance with them, and if other works were constructed to train and confine the whole of the tidal currents through the new course, it may be expected that the ebbing tides would pass out of the harbour with increased energy in a direction about N.N.E., and would probably produce a good entrance from the deep water of the North Bay corresponding pretty fairly with the natural set of the tides in that quarter. But without the training works to which I have alluded, the scouring power of the tides would be divided between the old and new courses, and thus there would be danger of even the new channel being injuriously silted up. No such works are suggested, but it is proposed to construct a northern breakwater outside the entrance, stretching from the Raven sandhills out into two fathoms soundings, in a direction east-by-south, crossing almost at right angles the natural set of the northern tidal streams. If erected it would therefore render it impracticable to obtain the better entrance in the northerly direction.

Notwithstanding the advantages that possibly may be derived from the proposed new channel, and supposing that it did prove effective in maintaining a northern entrance, there is a very grave objection to making the experiment; it is this, Hantoon Channel would be deprived of its scour, and the increased velocity of the tide passing out in the direction that has been described, would throw an eddy current into it, thereby causing deposit that would soon close it up. The safest, and therefore one of the most valuable entrances that Wexford Harbour probably ever had or can have, one that is securely available in all kinds of weather, would thus be lost.

I have calculated the probable cost of connecting the Town and Coal Channels as laid down on Captain Vetch's plan.

1. Taking it at 100 yards wide at bottom, 12 feet deep, as stated in the proposal to their Lordships, but at 2,500 yards long (which would be about its true average length), in place of 2,000, as was assumed, there would be 1,120,000 cubic yards to be removed. At 6 *d.* per yard, this would amount to 28,000 *l.*

2. Retaining the same width, but adopting Captain Vetch's increased depth of 18 feet, the number of cubic yards would be 1,770,000, and the cost, at the same price, would be 44,250 *l.*

3. The lines A B and C D, drawn on Captain Vetch's plan, outside those that show the cut 100 yards wide, indicate that he perhaps contemplated the ultimate completion of the full measure and making the new channel to correspond in sectional area with that of Coal Channel. If this were carried out, about three times the latter sum, or 130,000 *l.*, would be required for it.

How the least of these cuts could be executed for 10,000 *l.* I am at a loss to understand, unless it is assumed that, if a comparatively small opening were made in the first instance, the strong current, passing through, would deepen and widen it sufficiently. Supposing for a moment that such a result might be expected, it is one that should be avoided, as, no doubt, the soil so removed would be lodged somewhere in the channel of navigation, to its great injury, and should eventually be taken away by dredging at a cost at least as much as if removed in the first instance. This idea would, therefore, if entertained, lead to a fallacy as to the ultimate expense.

The second of the proposed works is, "That a north breakwater from the Raven shore towards the Vane buoy, about 1,700 yards long, should be made at a cost of 30,000 *l.*"

Captain Vetch says, he considers this "would be a good work," but "doubts if it could be executed for the money named;" and further gives his opinion that "eventually a south breakwater should be added." He concludes his report thus: "I may repeat here, that until the groynes alluded to by me, one on either side of the channel, be run out (as shown on chart by blue lines E. F. and G. H.), there can be no hope of a deep and permanent entrance to Wexford harbour."

I have already alluded to this proposed north breakwater, and have shown how its construction would fatally interfere with the entrance that might, possibly, be calculated on from the North Bay as a result of the successful execution of the cut into Coal Channel. As a single erection I have no doubt that the sand would travel round it, and be lodged inside; that it would create a conflict between the tidal streams, and produce, very probably, a much more confused state of the channels through the sandbanks than there is at present, multiplying their number, and consequently rendering all of less value for navigation.

As Captain Vetch, however, in order to carry out the principle of concentration on which he appears to have based his design for the works outside, very properly observes, that eventually a south breakwater should be erected in addition to the northern one, and so clearly contemplates the execution of the plan as a whole: I shall so consider it.

On reference to the lines laid down on the chart, I find that a width scarcely equal to that of the present natural entrance at low-water of spring tides, has been adopted for the new entrance between the ends of the breakwaters, and that the site of this new entrance is removed out to sea 2,850 yards from the present one. This width (about 650 yards) spreads as the shore is approached, until at the junction with the sandhills it becomes 2,300 yards.

The velocity of the tidal currents through the present entrance is about 4·2 knots per hour. The depth which nature has adjusted to it appears, from Captain Frazer's amended chart, to be so great as 61 feet. The new entrance would be 1·4 knot further out to sea, and, therefore, in order to fill the harbour in the same time as it now does, the tide should travel 5·6 knots per hour, or with one-third greater velocity than it requires through the present entrance. An equivalent sectional area would, of course, be necessary for this greater velocity, and as the widths of both entrances would be equal, this area could only be obtained by increased depth. If, therefore, the harbour is to be filled as quickly as it is now (which, at least, is necessary for its proper maintenance), a depth of probably 80 or 90 feet must be obtained between the ends of the breakwaters analogous to the depth in the present entrance.

The soil from the bed of the sea would thus be ploughed up some 50 or 60 feet deep, and lodged outside to form a bar, if not worse than the existing one, in certainly a much worse position. But this is not the only evil that would, in my opinion, result from the construction of these breakwaters.

This harbour is filled by eddy currents, thrown off the true tides of the offing. By these Dogger Bank is maintained in its general position, although subject to partial changes within the circle of the lines of eddy. The flood tides set in, both from the north and south, with this bank between them, running from the former point down in a direction about S. S.W., and from the latter N. by W., up through Hantoon Channel. Meeting outside the present entrance, they then pass in one collected stream into the harbour.

The breakwaters, if erected as shown on the chart by the blue lines E F and G H, would run directly across and intercept these flood-tides, which would thus be forced to turn, at right angles to their natural courses, along the backs of these solid stone obstructions, in a direction opposed to the flood that would be then passing through the new entrance, in order to join which they should again turn back, and so flow into the basin.

These conflicting conditions of the tidal streams would, of course, create violent reactions and disturbance of the waters, by which sand and gravel would be torn up and carried inside, there to form a bar. The scour of the ebb-tides would remove some of this, but only to lodge it on the bar outside.

Extensive sandbanks would be formed north and south of the breakwaters, and probably overtop them, altering materially and injuriously the natural contour of the coast by their projection out to sea. They would also afford abundant sources from whence the tides and waves would add to the deposit, both inside and outside the basin. This process, going on daily, and aided by the action of the breakers and storms on the outer banks, would, I much fear, soon create a far worse state of things than at present exists.*

But supposing for a moment that a deep channel to sea were maintained by the works that are proposed, it would be a dangerous one in bad weather, with so strong a current crossing the set of the tides outside. The entrance that did, at one time, exist in this direction, is stated by those who knew and used it to have been so bad, that lives were lost in navigating it.

Not having been furnished with any drawing from which the sectional area, that is proposed for this northern breakwater could be computed, I have assumed one of as limited dimensions as it appears to me would probably be adopted. I beg to send you a sketch of it herewith, and, in accordance with your instructions, the following estimate of cost.

There would be about 139 cubic yards in every yard forward, as per sectional area assumed; the length, measured on the chart, is 2,677 yards; the total content would, therefore, be 372,103 cubic yards. This, at 5*s.* per yard, and adding only 15 per cent. for staging, tramways, and contingencies, would amount to 106,980*l.*

In making this estimate, I have taken the breakwater as merely resting on the surface of the present sandy bottom, and allowed nothing for the sinking and settling down of the stones below that surface, nor have I taken into account protecting the ends of the breakwaters, so as to save them from the effect of the great tidal scour that would take place between them. This would be both expensive and difficult. The cost would, therefore, be considerably more than is above calculated. The southern line of breakwater measures 3,150 yards. It would be less in height than the northern one, but would not cost much less.

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* With reference to the improvement or creation of harbours upon this coast or any coasts similarly circumstanced, and which are subject to the changes that shifting sands and eddy tides must always produce, there is one principle which, in my opinion, should not be departed from. It is this: that no solid structure, projected into the sea, should be connected with the shore unless ample provision were made, by piled bridging or arching, to allow the fixed inshore currents to pass freely along in their natural courses.

Considered in the most favourable light, these works would be exceedingly expensive. Stone cannot be had for them nearer than in the neighbourhood of Wexford, and the heavier portions very difficult to be had at all. They should be shipped, taken to the entrance, unshipped, and lifted out of barges upon the proposed tramway.

With the highest possible respect for Captain Vetch, I must beg leave to differ with him in opinion as to the manner in which this harbour should be treated. Having given the subject a great deal of consideration, having observed the changes and different conditions of the banks and channels outside, and having waited to ascertain what effects might there be produced by the embankment of the lands within the harbour, I am still of opinion that what I proposed in 1846 is the safest and probably the best plan to adopt for improving the entrance, viz, "Encouraging, by piling, planting bent grass and other necessary means, the growth of Dogger Bank into a permanent island."

While the tides maintain their general courses out and in over the North Bar, and on the south through Hantoon Channel, in the directions I have described, they are, to some extent, diverted and wasted in flowing over the Dogger Bank, and through its swashways. The portion of the flood that takes this direction flows into the true channels in a line transverse to their currents, and, being charged with sand, does much injury. Notwithstanding this, the North and South streams are capable of preserving these navigation channels open to their present general extent.

I propose to prevent this injurious action and diversion of the tides over and through the sand banks, to concentrate their strength, and confine the whole of the tidal currents to the north and south courses that nature and the contour of the coast clearly indicate, and, finally, to make Dogger Bank the permanent means of maintaining those natural main channels in their improved condition.

I have laid down the line of the work by which it appears to me that this could be best effected. If executed, the sands would accumulate on its eastern side, and rapidly raise the Dogger Bank above the level of high water of spring tides.* If encouraged and protected, this bank would soon become permanently fixed and very extensive. The cross flow of the tides would be prevented, and the whole of the tidal scour confined to the navigation channels. Flowing out and in with the true set of the tides outside, it would, with the aid. in the first instance, of dredging in Hantoon, increase the depth materially, and, in my opinion, carry and preserve the increased depth out to sea. I should expect 12 feet at low water of spring tides at least The excessive velocity of the tide passing through the present entrance would be divided between these two channels, and each division, confined and guided as I have described, would maintain such a rate out to the deep water as probably, on reaching it, would be assimilated to the rate of the tide in the offing, which is about 2½† knots per hour.

Nature would thus be gently but effectively assisted, and all violent scour, reaction, and crossing of the tides avoided.

The line of work that I have laid down would probably be more cheaply and effectually executed by the aid of piling than by using stone. It could be carried on in sections, and, if suspended, would do no injury. The first section I should propose (if all could not be done at once) would be about 1,200 yards long, marked C D on the accompanying chart; it would check the present waste of the ebb tide out over Dogger Bank. The total length of line from the 2 fathom soundings on the north near the "Vane Buoy," to the same depth of water on the south near "Frazer Buoy," would be 3,900 yards. The breakwaters proposed by Captain Vetch would be 5,827 yards long. I calculate that the piled line might cost about 40*l.* per yard.

If the grant of public money, which it appears has been recommended to the favourable consideration of the Treasury for the improvement of this harbour be made, it may be fairly applied to the external works, as, no doubt, if the entrance were made deeper, many vessels besides those belonging to the port might use it as an auxiliary safety harbour; and if the Dogger Bank were raised as proposed,

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* I surveyed the banks outside in 1855, to ascertain what changes had taken place. A great portion of the Dogger bank was then about 4 ft 6 in over high water.

† Beechey.

it would form a breakwater that would in a great measure shelter the anchorage outside for vessels that did not require to come in, and that might lie there with greater safety in adverse winds than they can at present.

The internal work might be executed with the funds to be spared from the harbour rates. If, as it is stated, 1,200 *l.* a year can be had from that source, and if the Harbour Commissioners could make satisfactory arrangements to use the dredged material for ballast, a considerable sum being now annually paid for that article, the present dredger and plant might be profitably kept at work, improving the present sailing course. I have also laid down the line that I should recommend for this. It would be quite as short as the course proposed through Coal Channel, and pass out through the entrance in the direction that best suits the set of the tides outside. Being that which nature has made and maintained, it will interfere with none of her arrangements, but aid still more, when deepened, to improve the tidal currents north and south of Dogger Bank.

Note.—Mr. Farrell's Chart.

I beg herewith to return the documents sent to me, and with them a Chart, with the plans I have proposed laid down on it.

I am, &c.
(signed) *James B. Farrell.*

To the Admiralty Commissioners
for improving Wexford Harbour,
London.

To the Lords Commissioners of the Admiralty.

My Lords,

I HAVE been directed by the Wexford Harbour Commissioners to send your Lordships a copy of a Resolution entered into this day at a meeting specially convened to consider a communication from the Admiralty through Mr. Farrell.

I am, &c.
(signed) *John Richards,*
Secretary.

Ballast Office, 17 June 1859.

"AT a Special Meeting of the Wexford Harbour Commissioners at the Ballast Office on Friday the 17th of June 1859, in order to take into consideration a communication from the Admiralty through Mr. Farrell, John Walsh, Esq., Mayor, Chairman—

Resolved,—That, having considered the communication of the Admiralty Commissioners to Mr. Farrell relative to the depositing of the material raised from Hantoon, we desire our secretary to inform the Admiralty, that the place where it is now deposited is not used as an anchorage, and that if all the material contemplated to be raised were deposited there, would not, in our opinion, reduce the depth of water so much as to make it less desirable as an anchorage than at present; that we do not know of any place equally convenient where it could be deposited with less injury; and to carry it farther, would cause less quantity to be raised; that we are most anxious that the largest quantity possible should be raised and taken off Hantoon during this summer.

John Richards,
Secretary.

Sir,
Ballast Office, Wexford, 29 June 1859.

I BEG leave to send you a copy of a Resolution of the Wexford Harbour Commissioners, which they have desired me to send for the information of my Lords of the Admiralty, it being a Report of a Committee appointed to inspect the Hantoon Bar and the Coal Channel.

I am, &c.
(signed) *John Richards,*
Secretary.

W. G. Romaine, Esq., Secretary,
Admiralty.

"Wexford, June 27 1859.

"We, the undersigned, at the request of the Shipowners' Association, proceeded on board the "Erin" steam-tug to inspect Hantoon Bar and Coal Channel, and report what progress the dredge boat has made. On carefully sounding the Coal Channel, and comparing the soundings with Frazer's chart and Vetch's plan, it being then low water, we found no perceptible change in the soundings, where a portion dredged off Hantoon has been deposited, as shown us by James Blake and —— Devereux, pilots, Mr. Farrell, and master of the tug-boat, the distance traversed about 2,500 yards. On Hantoon the least water we found with staff and lead was 8 feet, and that portion between the buoys of the moorings for dredging, there was 8 to 8½ to 9 and 10 feet water, being an increased depth from that marked on the chart, which is laid down at 7 feet. From the foregoing observations, we strongly recommend that every exertion should be used during the remainder of the season in dredging this most desirable outlet.

(signed) "*R. Sparrow.*
"*J. R. Crosbie.*
"*Richard Allen.*"

(copy.)
J. Richards, Secretary,
W. H. Commissioners.

INSTRUCTIONS TO MR. COODE.

Sir, London, 25 July 1859.

As Chairman of the Admiralty Commission for the improvement of Wexford Harbour, appointed under an Act of Parliament in the year 1852, I have to acquaint you that, at a recent meeting of the Commissioners, it was resolved, "That the several plans and papers connected with Wexford be forwarded to Mr. Coode, C. E., Engineer to the Harbour Works at Portland, and that he be requested to report as to the best means, under the circumstances stated, of improving Wexford Harbour."

In accordance with the above resolution, I forward herewith several printed documents, containing, amongst others:—

1. A statement on the part of Mr. Redmond, M. P. for the borough of Wexford, as to the probable funds available for improvements.

2. Two reports, with plans, dated respectively 13 January 1855, and 15 June 1859, by Capt. Vetch, R. E., chief of the harbour department at the Admiralty, on the best mode of improving Wexford Harbour.

3. A report and plans by Mr. J. B. Farrell, C. E., county surveyor, and resident engineer at Wexford, dated 24 June 1859, on the same subject.

4. The second report of the Tidal Harbours Commission of 1845, Appendix B., which contains 15 printed reports on Wexford Harbour by engineers and others, including those of the Astronomer Royal, Sir John Rennie, C. E., the late Mr. Rendel, C. E.

5. Report and evidence of the Refuge Harbours Commission, 1859.

And, lastly, a copy of the charts containing the Admiralty surveys of Wexford, made in the years 1844 and 1859 by Capt. Frazer, R. N.

The above comprise all the documents, as far as I am aware, connected with the harbour.

You will observe, in the recent reports of Capt. Vetch and Mr. Farrell, that there is a great difference of opinion as to the best mode of treating the harbour; and, as the Admiralty Commissioners are desirous to lay out in the most useful manner the funds entrusted to their charge, and as in your capacity as a Refuge Harbour Commissioner, you have recently visited Wexford, and are well acquainted with the place, I have to request that, after a full consideration of the case, you will report, for the guidance of the Commissioners, on the following points:—

1. What would, in your opinion, be the best mode of improving Wexford Harbour, provided funds to the amount of 100,000 *l.* could be raised, as suggested by Mr. Redmond?

2. In what manner you would recommend the Admiralty Commissioners to expend the funds available, viz., a sum of about 5,000 *l.* in hand, with a yearly instalment of 1,000 *l.* for the next six years; a steam dredger and mud barges, &c., worth about 7,000 *l.*, and an income of about 300 *l.* a year from the surplus harbour dues, making a total of about 20,000 *l.* available for the improvement of the harbour?

3. Whether the soil dredged up in the Hantoon Channel may be deposited in the 28 feet hole, in the lower part of the Coal Channel, without injury to the harbour?

4. As to the effect the ebb tide would have on the entrance of the harbour, if the Coal Channel were opened, and the North or Gulbar Channel closed, and whether it is probable that the set of the stream would be so altered as to risk closing the Hantoon Channel.

Mr. Farrell, resident engineer at Wexford to the Admiralty Commissioners, has been acquainted that this subject has been referred to you, and he will be ready to afford you any further information you may require.

As you visited Wexford in September last, as a member of the Refuge Harbours Commission, and steamed out into the South Bay, and into the Coal Channel, and inspected all parts of the harbour, it will probably not be necessary to again visit Wexford; but should you consider it desirable, you are fully authorised to do so.

I am, &c.
(signed) *Robert Gordon,*
Rear-Admiral and Deputy Master of the Trinity House,
Chairman.

REPORT of *J. Coode*, Esq., C. E.

Sir, Weymouth, 27 December 1859.

I BEG leave now to submit my Report, in compliance with your letter of 25th July ult., forwarding several plans and papers, and conveying the instructions of the Admiralty Commissioners for the improvement of Wexford Harbour that I would report as to the best means, under "the circumstances stated, of improving Wexford Harbour."

As communicated to you in my letter of 15th August—after perusal and consideration of the several reports and documents submitted to me, and others to which my attention was directed—I found it necessary to request Mr. Farrell, C.E., of Wexford, to have a series of observations made upon the relative velocities and set of the tide streams at certain points near the North Bar, and in the East and Hantoon Channels outside the harbour, and also within the entrance. It was important that the observations should be made near the period of spring tides, and as free as possible from the disturbing influence of high winds. From the unsettled state of the weather, and the unsheltered character of the channels outside the harbour, it was impossible to obtain sufficient information until the end of October. The results of the observations were forwarded to me the early part of last month; and I have since that time given careful consideration to the whole matter.

The Harbour of Wexford having been so frequently reported upon, it will be quite unnecessary for me to offer any introductory or descriptive remarks; I will, therefore, proceed at once to the points on which the Commissioners desire my opinion, viz.:—

> First. As to "the best mode of improving Wexford Harbour, provided funds to the amount of 100,000 *l.* could be raised, as suggested by Mr. Redmond."

> Second. As to the manner in which I "would recommend the Admiralty Commissioners to expend the funds available; viz., a sum of about 5,000 *l.* in hand, with a yearly instalment of 1,000 *l.* for the next six years; a steam dredger, mud barges, &c., worth about 7,000 *l.*, and an income of about 300*l.* a year from the surplus harbour dues, making a total of about 20,000*l.* available for the improvement of the harbour."
>
> Third. "Whether the soil dredged up in the Hantoon Channel may be deposited in the 28 feet hole in the lower part of the Coal Channel without injury to the harbour;" and,
>
> Finally. "As to what effect the ebb tide would have on the entrance of the harbour if the Coal Channel were opened and the North or Gullbar Channel closed; and whether it is probable that the set of the stream would be so altered as to risk closing the Hantoon Channel."

With reference to the first question, Mr. Redmond proposes that, to the funds otherwise available, a sum of "say 50,000 *l.*, should be added by a grant in aid from the Treasury, in consideration of the value of the position of Wexford as a postal communication, the development of the fisheries contiguous, and the greater facility such improvement would afford to the saving of life and property in the frequent shipwrecks that are occurring on the neighbouring banks." It is manifest, therefore, that under every consideration the primary object to be attained by the expenditure must be the improvement of the Harbour entrance, and to this important question I have given careful attention.

The accumulation of sand forming the Dogger Bank is caused by the eddies due to the deflection of the main tide stream, which, in this part of the Irish Channel, sets about north-east on flood, and south-west on ebb; whereas immediately at the entrance of Wexford Harbour the current sets towards the north-west on the flood, and towards the south-east on the ebb. In consequence of the preponderating influence of south-westerly winds, the seaward end of the Dogger Bank has been carried towards the north-east, as will be seen by reference to the accompanying chart from Captain Frazer's survey, revised in 1856. As a proof of this movement of the outer or seaward end of the bank, I would observe that whilst the centre of the deep-water channel opposite the first buoy to the westward of the Raven Spit remains in the same position as at the time of Captain Frazer's survey of 1845, the channel just to the eastward of the Fairway Buoy has shifted to the north-east fully 600 yards. One serious evil consequent upon this alteration of the eastern passage for the tidal waters into and out of Wexford Harbour, has been the increase of the bar; for it appears that the distance between the depth of two fathoms in the Channel within, and the two fathoms line outside, was only 430 yards in 1845, whereas the distance was 700 yards in 1856. I have no doubt whatever that this accumulation on the bar is due to the circumstance of the direction of the harbour tides being diverted by the north-easterly movement of the sands on the outside of the Dogger Bank, to such an extent as to cause the tidal waters to pass in and out in a direction which is practically at right angles to the main current outside, which I consider to be the worst possible state of things as regards the formation of a bar. The more favourable condition of the Eastern Channel in 1845 indicates what I conceive to be the proper course to be adopted in this case, which is, so to direct the passage of the tidal waters, that the transition of the harbour tides, from and into the main stream, shall be as gradual and easy as possible.

The annexed chart shows by red colour the line of work which I have to recommend along the northern edge of the Dogger Bank. Commencing at a point about 500 yards to the eastward of Rosslare Point, the line would cross and close the swash-way lying to the east of Hantoon Channel, and thence run along the southern edge of the Eastern Channel until opposite the Fairway Buoy, where it would turn to the south-east, and terminate at the edge of the two fathoms line, with which it would unite by an easy curve, and fall in with the line of the offing tides, as indicated by the lines of two, three, and five fathoms soundings. That this is the proper direction to ensure the best channel I consider to be fully proved by the fact that the line eastward of the Fairway Buoy would be parallel to, and not far to the north of the channel of 1845, the condition of which, as already stated, was so much superior to that now existing; and as nature formed this channel without any protection from the southward, and notwithstanding the tendency of the south-westerly winds to divert it towards the north and east, we may safely conclude that with a covering work giving protection against the winds and cross-tides from the south and south-west, a channel once formed on this line would be self-maintaining. For the same reasons I consider that no artificial works on the north side of the channel would be necessary, more especially as the indraught of the flood stream running towards the Harbour entrance and covered by the proposed work, would counteract the tendency which exists under present circumstances to divert the channel towards the north-east.

It will be observed that I do not propose to close the Hantoon Channel; on the contrary, I believe that the effect of the dike shown on the chart will be to cause an improvement in the depth of water through this channel, and to give it a more permanent character. I consider that if the work were executed as I have shown, the line of deepest water would be more direct than at present, and that it would be as indicated by the dotted line on the chart.

The line of entrance between the groynes proposed by Captain Vetch in June 1859, and marked E F and G H, being at right angles to the direction of the tides on the outside, would, in my opinion, be objectionable, as the result would be the formation of a bar at the mouth, arising from the confliction of the currents.

Although the plan I have recommended for dealing with the approach to the harbour is, to a great extent, similar to that proposed by Mr. Farrell in his report of 24th June 1859, I cannot concur entirely with him, since, according to his plan, I consider that the eastern entrance would be open to the same objection as that of Captain Vetch; and the southern portion of Mr. Farrell's proposed line of piling would not effect so great an improvement in the Hantoon Channel as that which I have laid down, whilst it would be nearly 1,000 yards longer, and in deeper water.

With regard to the mode of constructing the work along the north edge of the Dogger Bank, I propose to form a dike, which, if the district had afforded suitable materials, should have been entirely of rubble stone, as recommended by Captain Vetch, for the groynes suggested by him in his reports of January 1855, and June 1859. As, however, there appears to be no means of procuring blocks of stone in the locality sufficiently large to give stability to the mass, I would recommend the employment of artificial concrete blocks varying from four to eight tons in weight, according to the depth of water and exposure in the work; they should be formed on shore, at a convenient spot within the harbour, and from broken stone and chippings procured from the quarries near the town of Wexford; made with Portland cement mixed with the clear sharp sand of the district, they would fully answer the required purpose. These blocks, and a small proportion of rubble stone from the same quarries, thrown in along the line of work, *à pierre perdue*, and aided by the accumulation of sand, would form a permanent and efficient dike, and be most economical as regards cost. Having regard to the length of railway that would have to be maintained, and the small depth of water, which would give a proportionately heavy cost per cubic yard of material if staging were employed, I should recommend that in this case the materials be conveyed by barges constructed for the purpose, and towed out by steam-tugs, the latter being fitted with steam cranes for the more expeditious and economical lifting and depositing the blocks. I fully concur in the recommendation of Mr. Farrell, to encourage by "planting bent grass and other necessary means, the growth of Dogger Bank into a permanent island."

Upon the assumption that dredging would be required to remove the sand at the eastern end of the proposed dike, I have estimated for the removal of so much material as would give 12 feet depth of water at lowest spring tides; I consider however that the artificial removal of the quantity here calculated upon, would so far aid the tidal currents as to produce by means of the scour an additional depth of at least from two to three feet, thus giving an ultimate depth of not less than 14 to 15 feet at low water, which I have no doubt would be fully maintained thereafter.

Taking

	£.
Taking the dike at 3,000 yards long and 15 feet wide at the top, which should be level with high water of spring tides, with a sufficiently flat slope seaward, I estimate its cost at	72,000
Additional work at inner and outer ends, including foundations for a lighthouse	6,000
Dredging at outer end, estimated at 1*s.* per cubic yard on account of exposure of site	17,800
TOTAL	£. 95,800

If the expenditure at Wexford Harbour is to be limited to 100,000*l.*, I have no hesitation in recommending the above as the proper mode of treatment; the case is confessedly a difficult one, but after much consideration, I feel satisfied of the success of the plan herein proposed.

As to the second question referred to me, it is manifest that any dredging operations outside the harbour can only be regarded as a temporary expedient if unaided by other works; and such a comparatively limited expenditure as is proposed in this case must of necessity be devoted to internal improvements, and in this respect I entirely agree with Captain Vetch, that "the most beneficial work" would be "the connecting the deep Coal Channel on the east with the deep Town Channel on the west." On the annexed chart will be found a line showing by red colour the direction and extent of the new cut which I should recommend for this purpose, if that work should at any time be undertaken. It is fully 500 yards shorter than that proposed by Captain Vetch, and would, I consider, be found equally efficient. If dredged to a minimum depth of 12 feet at low water of spring tides, and 100 yards wide at bottom, I estimate such a cut would contain 834,600 cubic yards, and at 6 *d.* per yard, would cost 20,865 *l.* As, however, this rate does not include the first cost of dredger and barges, but simply the working charges (including necessary repairs) for dredging and depositing, the cost will not come within the limits assigned. In the case submitted to me, the funds actually available for payment within the next six years would seem to be as follow:—

	£.
Amount now in hand	5,000
1,000 *l.* per annum for six years	6,000
300*l.* per annum from surplus harbour dues, say for six years	1,800
	£. 12,800

Inasmuch as no navigable cut to unite the Town and Coal Channel can be made for this sum, I see no alternative, if a larger amount cannot be raised for the purpose, than to improve the present North Channel by dredging on the line proposed by Mr. Farrell.

Estimating the works according to the soundings on the annexed chart, I consider the most that can be accomplished will be the deepening the North Channel, so as to give a depth throughout of 10 feet at low water of spring tides; this would cost 11,000 *l.*, and may be executed in two years. The case would then stand thus:—The first year's expenditure, say 6,000 *l.*, would be met by the sum of 5,000 *l.*, now stated to be in hand, and the first year's instalment of 1,000 *l.* At the expiration of the first year the sum of 5,000 *l.* might be borrowed on security of the further yearly instalments, and paid off at the rate of 1,000 *l.* yearly, the interest in the meantime being paid out of the surplus harbour dues.

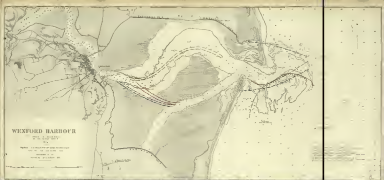
As regards the third point, I consider the depositing the soil dredged up in the Hantoon Channel in the 28-feet hole, in the lower part of the Coal Channel, as a most injudicious step; so objectionable indeed, that I should have replied to this question without waiting for the results of the tidal observations, had I not noticed that the practice had been most strictly and properly prohibited by the Admiralty Commissioners' instructions to Mr. Farrell, dated 20th June 1859.

In reply to the last question, I am of opinion, that if the Coal Channel were opened, and the North or Gull-bar Channel closed, the effect on the entrance to the harbour would be beneficial to a slight extent; but at the same time I consider that no improvement within the harbour will *alone* lead to any satisfactory result as regards the entrance; for the amelioration of the latter to any really useful extent, external works, and those only, will suffice. I do not consider that shutting up the North Channel and opening the Coal Channel would risk the closing of Hantoon Channel; the only effect would probably be to divert the Hantoon Channel a little further to the eastward. If the Coal Channel were closed, and the North Channel deepened, the Hantoon Channel would doubtless be improved to some extent, but at the sacrifice of the East Channel; this latter course is, however, one that I would certainly not recommend.

Having replied to the several questions referred to me, I would beg leave to state my opinion that if sufficient funds could be provided, the proper treatment for Wexford Harbour would be to execute both the dike along the north edge of the Dogger Bank, as shown on the annexed chart, and the cut to connect the Coal Channel with the Town Channel, the cost of which would appear, according to the information at present at my disposal, to amount together to about 117,000 *l.* assuming the free use of the present dredger and barges, but without an allowance for engineering and superintendence, which I have omitted in each case, as I am not aware of the extent of the present establishment, and consequently what increase would be requisite; but it appears to me that a sum of 125,000 *l.* would amply suffice to cover all costs and charges that would be necessary to effect such improvements in Wexford Harbour as would render it worthy of the important position which it occupies.

I have, &c.
(signed) *Jno. Coode.*

Rear Admiral Robert Gordon,
&c. &c. &c.
Chairman of Admiralty Commissioners
for the Improvement of Wexford Harbour.


WEXFORD HARBOUR

WEXFORD HARBOUR.

COPY of REPORT upon WEXFORD HARBOUR by Mr. *Coode*, C.E., and of the PLAN connected therewith, and of other PAPERS on the same Subject, to the Lords Commissioners of the Admiralty.

(*Mr. Redmond.*)

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